

## WHAT IS CLAIMED IS:

1. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:
  - a vehicle adapted to ride on the surface;
  - 5 a head assembly adapted to carry a device for engaging and treating the surface;
  - a support;
  - a connector assembly interconnecting the head assembly and the support;
  - 10 an actuator on the vehicle for raising and lowering the support relative to the surface;
  - a sensor detecting a distance between the support and the head assembly;
  - a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the support; and
  - 15 a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the support so that the distance between the support and the head assembly as detected by the sensor corresponds to the desired position as indicated by the head position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly.
  - 20
  - 25
2. The apparatus of claim 1 wherein the sensor comprises a linear potentiometer.
3. The apparatus of claim 2 wherein the head position control is a operator-controlled potentiometer and further comprising a comparator for comparing a voltage signal generated by the operator-controlled potentiometer to a  
5 voltage signal generated by the linear potentiometer, said comparator providing an output signal corresponding to the comparison to the driving circuit.

4. The apparatus of claim 1 further comprising an up/down switch responsive to the operator and connected to the driving circuit for selectively controlling the actuator such that when the switch is in an UP position, the actuator  
5 is energized to raise the support and such that when the switch is in a DOWN position, the actuator is energized to lower the support.

5. The apparatus of claim 1 wherein the connector assembly has a first end engaging the head assembly and having a second end engaging the support wherein a distance between the first end and the second end is variable.

6. The apparatus of claim 5 wherein the support is a traveling nut, wherein the actuator comprises a motor rotating a screw which engages and drives the traveling nut, said nut being raised and lowered by rotation of the screw,  
5 and wherein the connector assembly comprises:

a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the traveling nut, the tube supporting the head assembly at its other end;  
and

10 a compressible member within the tube having one end engaging the nut and having another end engaging the tube;  
and

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

7. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

5 a head assembly adapted to carry a device for engaging and treating the surface;

an actuator on the vehicle supporting the head assembly over the surface and adapted to raise and lower the head assembly relative to the surface;

Sub B1  
10 a sensor detecting a position of the head assembly relative to the surface;

a head position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the surface; and

15 a driving circuit responsive to the head position control and responsive to the sensor for energizing the actuator to raise and lower the head assembly so that the position of the head assembly relative to the surface as detected by the sensor corresponds to the desired position as indicated by the head position control thereby  
20 controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly.

Sub A 39 8. The apparatus of claim 7 further comprising:  
a support connected to the actuator and being raised and lowered by the actuator;

5 a connector assembly including a compressible member between the support and the head assembly;

wherein the sensor comprises a distance sensor connected between the support and the head assembly for detecting a distance between the support and the head assembly; and

10 wherein the driving circuit responds to the distance sensor to control the head position of the head assembly relative to the surface to maintain contact between the head assembly and the surface.

10 9. The apparatus of claim 8 wherein the distance sensor is a linear potentiometer.

Sub A 40 10. The apparatus of claim 7 further comprising:

a support adapted to be raised and lowered by the actuator;

a compressible member of variable length between the support and the head assembly; and

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

11. The apparatus of claim 7 wherein the actuator comprises a motor rotating a screw driving a traveling nut engaging the screw, said nut being raised and lowered by rotation of the screw, and further comprising:

a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the traveling nut, the tube supporting the head assembly at its other end; and

a compressible member within the tube having one end engaging the nut and having another end engaging the tube; and

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

<sup>13</sup>  
12. The apparatus of claim <sup>12</sup>11 further comprising an inner tube coaxial with and slidable within the slotted tube, the inner tube connected to and moving with the support.

*Sub A 41* 13. The apparatus of claim 11 wherein the sensor comprises a detector for providing a count corresponding to the position of the head, wherein the head position control is set by the operator to indicate the additional preset amount and further comprising a comparator for comparing the count to the additional preset amount, said driving circuit being responsive to comparator to lower the traveling nut below a repeatable position when the count corresponds to a position which is higher than the additional preset amount as indicated by the head position control.

<sup>16</sup>  
~~14.~~ The apparatus of claim ~~13~~<sup>15</sup> wherein the detector comprises a magnet adapted to rotate in synchronism with the screw, a Hall sensor detecting rotation of the magnet and providing a pulse, and a counter for counting the pulses of  
5 the Hall sensor, and wherein the comparator compares the count of the counter to the additional preset amount.

<sup>17</sup>  
~~15.~~ The apparatus of claim ~~14~~<sup>16</sup> further comprising a switch for detecting when the nut is in the repeatable position and wherein the switch resets the counter and wherein the driving circuit is responsive to the comparator  
5 to lower the traveling nut a number of counts corresponding to the additional preset amount.

<sup>14</sup>  
~~16.~~ The apparatus of claim ~~15~~<sup>12</sup> wherein the sensor comprises a switch on the tube for detecting compression of the compressible member wherein the repeatable position corresponds to the position of the device when it engages the surface.

*Sub A 42* <sup>17</sup>  
~~17.~~ The apparatus of claim 7 wherein the sensor comprises a switch on the actuator for detecting a position of the head assembly.

<sup>8</sup>  
~~18.~~ The apparatus of claim 7 further comprising a vehicle having pneumatic tires for riding on the surface, said vehicle supporting the actuator such that the head assembly is above or on the surface.

*Sub B 2*  
5 19. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:  
a head assembly adapted to carry a device for engaging the surface;  
an actuator raising and lowering the head assembly relative to the surface;

*Sub B2*  
10 a position control responsive to operator input for indicating a head position of the device relative to the surface or range of head positions of the device relative to the surface, said head position or said range of head positions indicating a distance or range of distances, respectively, between the device and the surface; and

a controller responsive to the position control for selectively actuating the actuator to maintain the device in  
15 the head position or within the range of head positions as indicated by the position control.

*Sub A43*  
20. The apparatus of claim 19 further comprising:  
a motor on the head assembly for rotating the device;  
a torque control circuit having an input receiving a signal for controlling the torque of the motor;

5 a torque control responsive to operator input for indicating a desired torque or a desired range of torques for the motor; and

wherein the controller is responsive to the torque control for providing a torque control signal to the input  
10 of the torque control circuit to maintain the motor at the desired torque or within the desired range of torques.

~~22~~ 21. The apparatus of claim ~~20~~ further comprising:  
a pressure sensor detecting the pressure of device on the surface;

5 a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the device on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating the actuator to maintain the pressure of the device on the  
10 surface at the desired pressure or within the desired range of pressures.

~~20~~ 20. The apparatus of claim 19 further comprising:

a pressure sensor detecting the pressure of device on the surface;

5 a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the device on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating the actuator to maintain the pressure of the device on the surface at the desired pressure or within the desired range of pressures.

23. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

*Sub B3*  
a head assembly adapted to carry a device for engaging the surface;

5 an actuator raising and lowering the head assembly relative to the surface;

a position control responsive to operator input for indicating a repeatable head position of the device relative to the surface or a repeatable range of head positions of the device relative to the surface, said repeatable head position or said repeatable range of head positions indicating a distance or range of distances, respectively, between the device and the surface; and

10 a controller responsive to the position control for selectively actuating the actuator to maintain the device in the repeatable head position or within the repeatable range of head positions as indicated by the position control.